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MUNICIPAL AND INDUSTRIAL WATER SUPPLY STORAGE REQUIREMENTS, OKATIBBEE CREEK RESERVOIR, MERIDIAN, MISSISSIPPI

Public Health Service
Atlanta, Georgia

April 1961

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MUNICIPAL AND INDUSTRIAL WATER SUPPLY STORAGE REQUIREMENTS OKATIBBEE CREEK RESERVOIR MERIDIAN, MISSISSIPPI

Prepared for

U. S. Army

Corps of Engineers

Mobile District

Department of Health, Education, and Welfare
Public Health Service, Region IV
Water Supply and Pollution Control Program
Atlanta, Georgia

April 1961

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(6/1/61)

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SUMMARY

1. The topography and development of Lauderdale County area along Okatibbee Creek are such that only the City of Meridian is considered to need water from the proposed Okatibbee Creek Reservoir. In the future, all industries in the city and adjacent to it, with the exception of Mississippi Power Company, are assumed to obtain their water from the city.

2. Ground water and other surface water supplies in the immediate area are either more expensive or inadequate to meet the city's water needs by 2015. Existing sources and water treatment facilities are taxed to their full capacity and expansion is presently needed.

3. Both ground and surface waters of the area are of such quality that approximately the same degree of treatment is needed for each. Costs of treatment from either source are considered to be the same.

4. Wastes treatment and disposal requirements can be met with present facilities for several years, but water quality below the city may be adversely affected as the city grows. Wastes presently discharged by industry directly to the stream have a five-day 20°C. BOD population equivalent of 24,000. Combined domestic and industrial wastes having a P.E. of 27,000 are treated in the activated sewage treatment plant, and only 11% of the 27,000 P.E. reaches the stream.

5. Population of the City of Meridian is expected to increase from a 1960 total of 49,374 to 64,900 in 1980 and 104,900 in 2015. Employment in Meridian is expected to increase from a 1960 total of 18,950 to 23,650 in 1980 and 37,800 in 2015.

6. Water demands on the city system are expected to increase from an average of 5.5 mgd in 1960 to 12 mgd in 1980 and 25 mgd in 2015. Other water sources of Lauderdale County supplied 4.5 mgd in 1960, and this will increase to 6 mgd in 1980 and 11 mgd in 2015.

CONCLUSIONS

1. Ground water will remain the major source of water for users outside the City of Meridian over the expected 50 year economic life of the proposed project. However, the possible use of surface water by the Mississippi Power Company's Plant Sweatt should be studied in more detail with company officials.

2. The annual value of water supply storage at the Corps project designed to supply, at the end of the economic life of the project, an average of 25 mgd of municipal and industrial water for Meridian is $102,000.

3. Water quality in Okatibbee Creek, south of Meridian, to Chunky Creek will be adversely affected if flows in the creek are reduced below three to five times the wastes discharged to that stream. Maintenance of stream quality should be considered and more detailed analysis made of the problem in the final planning stage.

INTRODUCTION

General

In correspondence dated 17 February and 23 September 1960 the District Engineer, Mobile District of Corps of Engineers, U. S. Army requested the Public Health Service, Region IV Office to evaluate the need for water supply storage in the proposed Okatibbee Creek, Mississippi project. This determination was to include water supply storage for the Meridian, Mississippi area and the value of such water. This request is in accordance with a Memorandum of Agreement, dated November 21, 1958, between the Corps of Engineers and Public Health Service.

The water supply needs in Lauderdale County, which includes Meridian, were evaluated for the period up to year 2015. After careful consideration, all areas outside the immediate vicinity of Meridian were excluded from consideration.

Acknowledgments

Acknowledgment is gratefully made for the assistance of the Mississippi State Board of Health, City of Meridian Officials, Lauderdale County Health Department, and various other state, county and local agencies as well as private industries and utility companies in the area.

DESCRIPTION OF STUDY AREA

River Basin

Okatibbee Creek rises near the Neshoba - Kemper County line and drains an area of 367 square miles along the border of these two counties and the western half of Lauderdale and Clarke Counties. The basin has a maximum length of 39 miles and an average width of ten miles. The creek, which is about 55 miles long, flows in a southeasterly direction to its junction with Chunky Creek. Its principal tributary is Sowashee Creek which enters Okatibbee Creek southwest of the City of Meridian.

Chickasawhay River is formed by the confluence of Okatibbee and Chunky Creeks, and flows 164 miles in a southerly direction, joining the Leaf River near Merrill, Mississippi, to form the Pascagoula River. The Pascagoula River flows 81 miles in a southerly direction to Mississippi Sound in the Gulf of Mexico.

The Pascagoula Basin with a drainage area of 9700 square miles is the second largest in the State of Mississippi. The Basin has attracted primarily because of the availability of suitable timber. Paper, pulp, and chemical industries are the most predominant in the Meridian area.

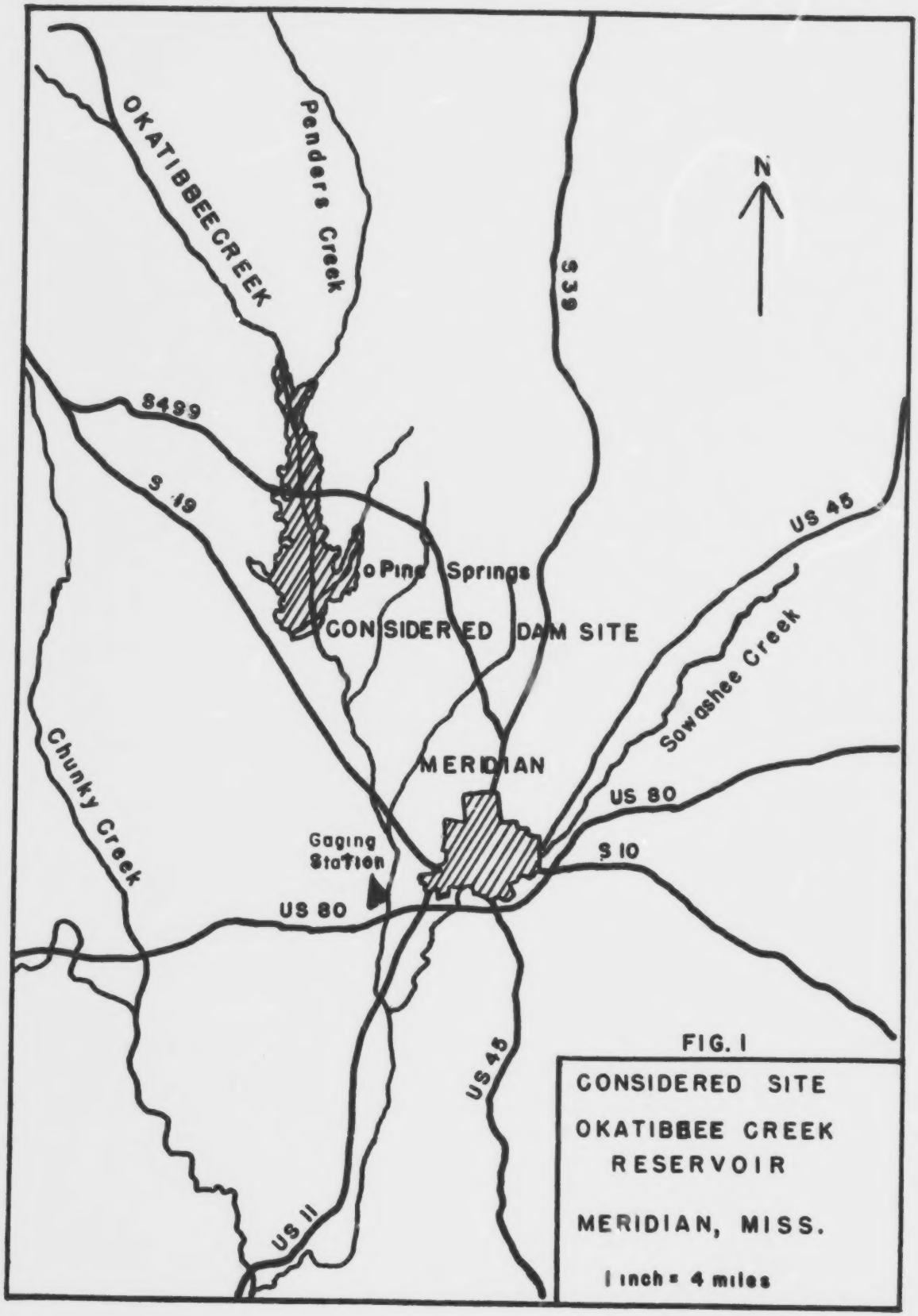
Waste from these industries plus municipal sewage have in the past contributed to pollution of Sowashee Creek and the main stem of Okatibbee Creek below Meridian. Recently, treatment facilities have been constructed for the City of Meridian which has reduced this waste load considerably.

Reservoir Site

The proposed site for the Okatibbee Creek Dam is 6-7 miles northwest of Meridian in Lauderdale County and 32.0 river miles above the mouth of the creek. Runoff would be collected from a 154 square mile drainage area above the dam. The purpose of the dam is to control floods along the lower reaches of the creek and provide storage for a municipal and industrial water supply for the Meridian area.

Stream Characteristics

Okatibbee Creek is about 55 miles long and has a fall of 24 feet per mile for the uppermost five miles beginning at the divide and an average of three feet per mile for the remaining length of the stream. The channel is 60-100 feet wide with banks 10 to 20 feet high. It has a capacity of about 2000 cfs at bankfull stage near Meridian.


OKATIBBEE CREEK
Penders Creek
S39
N
S499
S 19
US 45
Pine Springs
CONSIDERED DAM SITE
Sowashee Creek
Chunky Creek
MERIDIAN
US 80
Gaging Station
S 10
US 80
US 45
US 11
FIG. 1
CONSIDERED SITE
OKATIBBEE CREEK
RESERVOIR
MERIDIAN, MISS.
1 inch = 4 miles

HYDROLOGY AND TOPOGRAPHY

Streamflow Data

Gaging Station - Okatibbee Creek near Meridian.

Location - At bridge on old U. S. Highway 80, half a mile upstream from Alabama and Vicksburg Railway Bridge, two miles downstream from Loper Creek, three miles west of Meridian, and four miles upstream from Sowashee Creek.

Drainage Area - (Above Station) 239 square miles (Area above proposed project is 154 square miles)

Records Available - October 1938 - September 1950, and low flows for years 1952-1960.

Minimum Discharges - (1938-1950) Daily-2.3 MG on August 27 and 28, 1943; 7 day-2.6 mgd August 23-29, 1943; 30 day-6.1 mgd September 29 to October 28, 1948.

Minimum Discharges -

(1952-1960)	cfs	mgd
October 28, 1952	0.73	0.5
September 16, 1954	1.64	1.1
October 22, 1954	2.57	1.7
October 20, 1955	4.86	3.2
October 19, 1956	2.80	1.8
July 11, 1960	8.36	5.4

Duration of Flow - (Percent of time flow is equal to or greater than figure shown)

Percent of time	Discharge - cfs At Station	Discharge - cfs Per Sq. Mile
98	7	0.029
95	10	.041
90	14	.058
50	103	.430
20	473	1.98
5	1460	6.10

Extreme and Average Flows -

Average discharge - 10 years, 330 cfs
Maximum discharge - 16,300 cfs, Jan. 7,'50
Minimum discharge - 0.73 cfs, Oct. 28, '52

Runoff and Rainfall Data

The average annual flow of Okatibbee Creek at Meridian is 330 cfs. This area of Mississippi has an annual runoff of 18-20 inches or approximately one-third of its rainfall.

The average annual precipitation near Meridian is 55 inches, based on a 67-year period of record. Thirty-nine percent of the precipitation falls during the winter months of December, January and February; 29 percent in the Spring months; 25 percent in the summer months; and 16 percent in the fall months.

Topography

Okatibbee Creek lies wholly within the North Central Hills (Plateau) physiographic district of the State. The stream has a fairly deep, broad valley flanked by high ridges and hills 350-400 feet above sea level. Soils in this area have been derived from the weathering of Eocene Age formations in the Clariborne and Wilcox groups which consist of sands, sandstones, clays, claystones and gravel.

The Wilcox group, which overlies the Midway group, crops out in an area lying approximately north-east of a diagonal line from the northwest to the southeast corner of Lauderdale County.

Geologic Formations

Most of the sources of ground water in the Meridian area are in the Nanafalia formation of the Wilcox group, Eocene series. This formation ranges in thickness from about 250 to 300 feet. This formation is composed of clay, fine silty sand, and medium

to coarse sand near the base. Lignite and Kaolinitic clay are common throughout the formation.

The strike of the formations is generally northwestward and the dip (slope) is to the southwest at about 40 feet per mile. The base of the Nanafalia formation varies from 300 feet above MSL in the northeast corner of the county to 1200 feet below MSL in the southwest corner of the county, being about 500 - 700 feet below MSL at Meridian.

ECONOMY AND POPULATION

Economics

Economy of Lauderdale County - The economy of Lauderdale County is predominantly agricultural. Livestock production is the main agricultural activity in the county, making up 61 percent of the total farm income. Crop production accounts for 36 percent of total farm income and the sale of forest products from farms accounts for the remaining three percent. Crop production is diversified; corn, sorghums, cotton, and small grains being the principal crops grown.

Resources of Lauderdale County - In addition to the human resource the principal resources of economic importance in the county are land, water, forests, and clay. The forest resource covers approximately 40 percent of the land area of the county. It provides most of the raw material for the lumber and woods products industry in the county. Clay is extracted commercially for the local manufacture of brick, tile, and other clay products.

Population

The population of Lauderdale County has increased steadily although slowly during the history of the county. From 1930 to 1960 the annual rate of growth was 0.8 percent compounded. This compares with an annual rate of growth of 0.25 percent compounded for the State of Mississippi as a whole. While the total county population has been increasing, the rural population of the county has been decreasing. From 1950 to 1960 the rural population decreased from 22,278 or 34.7 percent of the total, to 17,745 or 26.4 percent of the total. This amounted to a decrease in rural population of 20 percent during the decade.

In 1950 the urban population in the county was 41,893 or 65.3 percent of the total population of 64,171. In 1960 the urban population was 49,374 or 73.6 percent of the total population of 67,119.

According to the definition of the Bureau of the Census there were no cities in the county in 1960 other than the county seat of Meridian. During the past 30 years the City of Meridian has had an annual growth of 1.45 percent compounded. The populations for the period 1930-1960 for Lauderdale County and the City of Meridian are shown in Table 1.

TABLE 1
POPULATION - LAUDERDALE COUNTY AND CITY OF MERIDIAN

Census Year	Lauderdale County	Meridian
1930	52,748	31,954
1940	58,247	35,481
1950	64,171	41,893
1960	67,119	49,374

Industrial Development

The bulk of the industrial development in Lauderdale County is in and surrounding the City of Meridian. A tabulation of economic indicators of economic development and growth in Lauderdale County, as shown in Table 2, denotes a considerable amount of economic growth in the county.

TABLE 2
INDICATORS OF ECONOMIC GROWTH - LAUDERDALE COUNTY

	1957 = 100				
Indicator	1955	1956	1957	1958	1959
Bank Clearings	63	92	100	107	120
Postal Receipts	91	97	100	112	124
Building Permits	109	106	100	158	113
Taxable Volume of Retail Sales	86	94	100	114	130
Taxable Volume of Wholesale Sales	114	113	100	107	110
Electric Meter Connections	96	99	100	102	106
Gas Meter Connections	94	97	100	103	106
Telephone Connections	89	95	100	106	113
Automobile Registrations	88	96	100	120	---

Between 1947 and 1954 manufacturing employment decreased by about 1.8% from 4321 to 4245. By 1959, however, manufacturing employment had increased to 5005. Food products, apparel, lumber and wood products, pulp and paper products, clay and cement products, and metal products make up the major part of the manufacturing enterprises. Other industrial enterprises include chemicals, printing and publishing, and other miscellaneous manufactures. Still other industrial activity includes wholesale and retail trade; personal and other services including transportation, utilities and finance; construction; and mining.

Employment

Table 3 shows employment in Lauderdale County in 1950 and 1960 as reported by the Bureau of Census.

TABLE 3
EMPLOYMENT IN LAUDERDALE COUNTY, 1950 and 1960

Employment Category	Number Employed		Percent of total employment	
	1950	1960	1950	1960
Agriculture, forestry, and fisheries	3007	2300	12.4	9.2
Manufacturing	4608	5200	19.0	20.7
Mining	12	25	0.1	0.1
Construction	1306	1700	5.4	6.8
Retail and Wholesale Trade	5262	6050	21.7	24.1
Services incl. Transportation Utilities, and Communications	8566	7825	35.4	31.1
Government	1458	2000	6.0	8.0
Total	24,219	25,100	100.0	100.0

EXISTING MERIDIAN AND LAUDERDALE WATER SUPPLIES

Present Sources

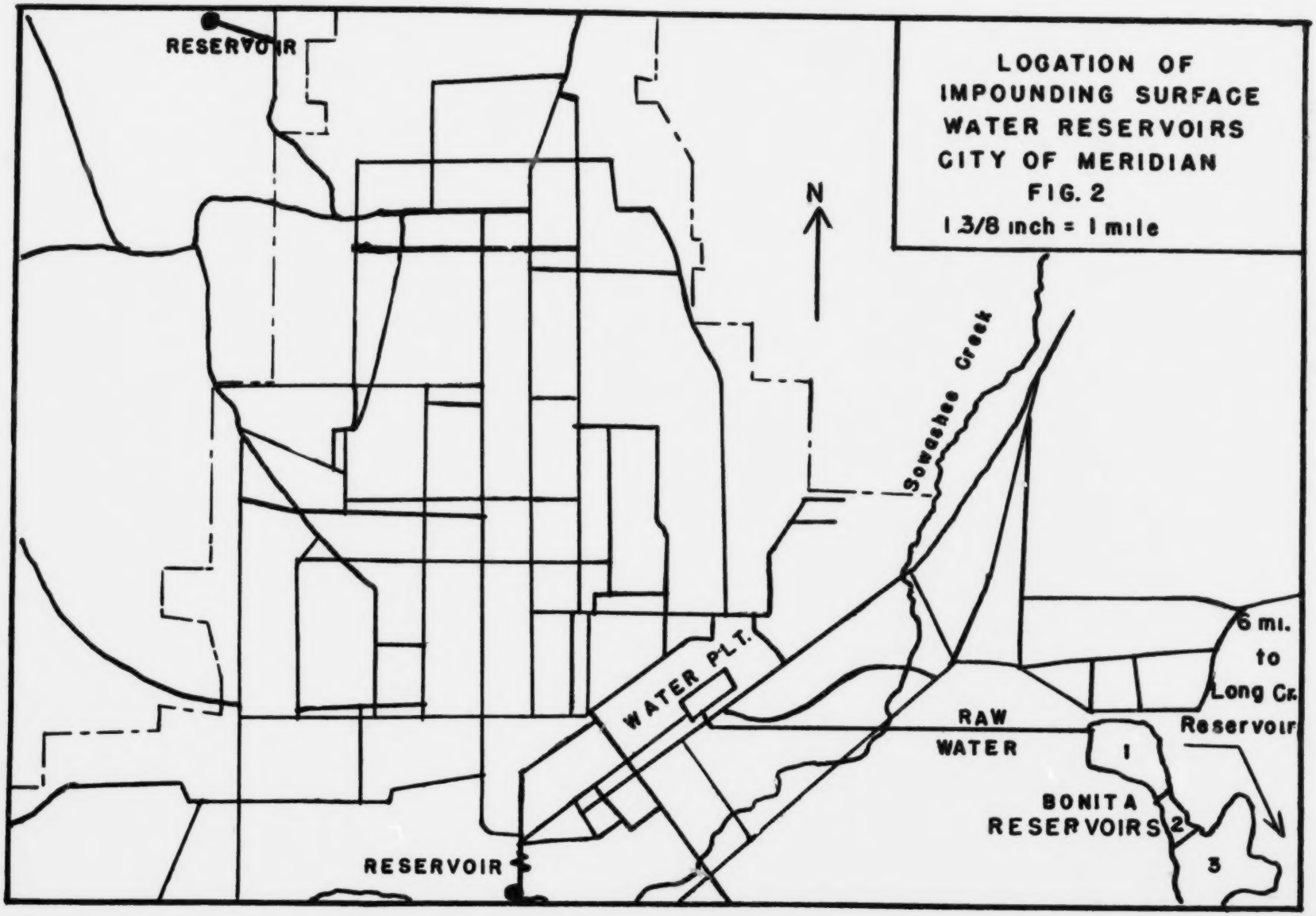
City water is taken from a series of impoundments located on a small Sowashee Creek tributary Southeast of the city and from two wells located at the water treatment plant site. The impoundments are known as Bonita 1, 2, and 3 and Long Creek Reservoirs. The present capacity of the impoundments is estimated at two billion gallons collected from the runoff of a heavily timbered, sparsely populated area consisting of some pasture and farmland.

Raw water from the Bonita Reservoirs flows to the treatment plant by gravity. The Bonita reservoirs are interconnected so that water can flow from 3 (upper reservoir) and 1 to the plant; 3 and 2 to 1; or from 3 to 1 bypassing 2. Long Creek reservoir is approximately six miles southeast of Bonita and water is transferred from Long Creek to Bonita by pumping. This pumping station includes one 5000 and one 3500 gpm horizontal centrifugal pump, both diesel driven.

The four reservoirs are reported to fill every year, but are inadequate during dry periods. Surface water is supplemented with ground water from two wells near the plant. The wells can supply approximately 2.4 mgd. Data on each are presented in Table 4.

TABLE 4
GROUND WATER SOURCES - CITY OF MERIDIAN

Well No.	Age	Size and Depth	gpm	Protection	Controls
1	1952	12 x 780	800	Housed	Manual
2	1954	12 x 780	1000	Housed	Manual


LOCATION OF
IMPOUNDING SURFACE
WATER RESERVOIRS
CITY OF MERIDIAN
FIG. 2
1 3/8 inch = 1 mile
N
RESERVOIR
Sowashee Creek
WATER PLT.
RAW
WATER
6 mi.
to
Long Ck.
Reservoir
1
BONITA
RESERVOIRS
2
3
RESERVOIR

Water Quality (See Table 5)

Surface Water - Fishing and boating are allowed on the raw water impoundments, but no water contact sports are permitted. The water quality if uniformily good except for a consistent manganese content of 0.3 ppm or more. At turnover periods manganese content increases to as much as 5.0 ppm. This manganese is reported to be due to chemical reactions in the soils due to use of dolomitic lime and basic slag for pastures and farming in the area.

Some problems have developed with algae growth on these reservoirs in previous years. However, this is easily controlled by use of copper sulfate. The reservoir waters are generally low in turbidity, but may contain some color at times. Some taste and odor problems develop at certain periods of the year.

Ground Water - The well water ranges from low to high in iron content and requires aeration and filtration for iron removal. Deep wells in the Meridian area have a high carbon dioxide content and a low pH. The city wells have a pH of around 6.3 to 6.5. Wells throughout the county have a hardness of less than 60 ppm, total solids of less than 210 ppm, and are low in chlorides.

Finished Water - The chemical quality of the finished water is good. The pH is maintained at 8.0 to 9.0, chlorine residual at the plant is 0.75 ppm and the fluoride content is approximately 1.0 ppm.

The bacteriological quality is routinely checked by laboratory personnel and the State Health Department and is found to be negative in over 99% of the samples.

TABLE 5
WATER QUALITY
MERIDIAN AND LAUDERDALE COUNTY, MISSISSIPPI

Date	Owner, Well No. and Depth	SiO_2	Total Solids	Total Hardness $CaCO_3$	Alkalinity P	Alkalinity M	Calcium as Ca	Magnesium as Mg	Manganese as Mn	Total Iron	Free CO_2	pH	Fluorides	Chlorides	Sulfates	Na+K as Na	Turb.	Color	Odor	Temp.	Specific Conductance (Micro mhos @ 25°C)
	WELLS OUTSIDE MERIDIAN																				
*12/ 1/55	J. D. Clark & Son D16 136'	16.	128.	24.	-	-	6.5	1.8	-	2.2	-	7.1	0.2	10.	12.	-	-	27	-	-	298.
*10/25/56	Ben T. Clayton D11 223'	-	48.	7.	-	-	1.9	0.6	-	15.0	-	6.2	0	3.0	4.6	-	-	7	-	-	43.4
* 3/15/57	Naval Air Station C1 228'	4.7	106.	21.	-	-	4.2	2.6	-	6.3	-	6.3	-	2.5	11.	-	-	7	-	64.5	87.8
* 4/22/57	Meridian Air Base Test Well 139'-228'	0.0	50.1	23.0	-	25	2.9	1.2	-	6.0	22	5.4	0.0	5.0	10.7	9.3	2	-	-	-	-
* 6/10/57	M.A.A. Station Test Hole No. 6	5.6	39.6	9.7	-	4	-	1.9	-	1.0	55	5.2	0.0	5.0	15.6	8.1	>2	0	-	-	-
** 6/14/53	Miss. Power Company Well No. 4 950'	6.8	146.6	12.0	-	116	4.3	0.0	-	0.7	12	7.3	0.0	8.0	2.8	54.4	-	-	-	-	-
** 6/16/53	Miss. Power Company Well No. 5 950'	4.4	144.1	20.5	-	110	7.2	0.0	-	1.5	19	7.1	0.0	9.0	6.1	49.9	-	-	-	-	-
**10/22/54	U. S. Fish & Wildlife Service - M102 728'	7.8	193.	[illegible]	-	-	5.6	0.6	-	0.30	-	7.9	0.3	4.0	8.8	-	-	5	-	72	295.
**10/22/54	U. S. Fish & Wildlife Service - M2	-	210.	10.	-	-	2.5	0.8	-	0.08	-	8.7	-	2.8	5.8	-	-	5	-	65	341.
	MERIDIAN CITY SUPPLY																				
6/12/51	Lake No. 3	5.2	27.0	8.0	-	-	1.6	1.1	-	0.6	-	6.2	0.0	2.8	1.9	-	-	25	-	-	25.8
6/12/51	Lake Composite	4.5	38.0	18.0	-	-	5.4	1.2	-	0.1	-	6.8	0.0	3.2	8.4	-	-	10	-	-	49.5
6/30/53	Lake	-	-	12.3	0	4	1.2	2.0	0	0.6	4	6.3	-	0.0	-	-	2	5	-	-	-
5/ 1/58	Lake Composite	-	40.0	32.5	-	-	-	-	-	-	5	6.3	-	10.0	-	-	-	-	-	-	-
6/30/53	Well - West of Plant M4	-	120.1	28.5	-	84	6.6	Tr.	-	6.8	46	6.6	0.2	9.0	2.3	-	-	-	-	-	-
12/ 9/55	Well - M13 296'	-	142.0	55.	-	-	18.	2.5	-	0.15	-	6.5	-	3.5	11.	-	-	5	-	66.5	183.
12/19/55	Well - Composite - M3 and M4 760'-769'	0.18	130.	16.	-	-	6.4	0	.02	-	-	7.3	0.1	7.0	6.1	-	-	0	-	77	198
11/ 2/60	Well East of Plant (Drilled 1954) M3	0.8	114.0	20.0	-	86	6.0	1.4	-	2.0	59	6.5	0.0	9.0	5.9	39.0	>2	-	-	-	-
11/ 2/60	Well West of Plant (Drilled 1952) M4	0.0	109.0	17.0	-	80	5.0	1.1	-	2.0	55	6.5	0.0	9.0	6.4	44.0	>2	-	-	-	-
6/30/53	Filtered Water	-	49.0	27.1	6	11	10.9	0.0	-	0.0	0	8.8	1.0	8.0	8.9	-	2	0	-	-	-
5/ 1/58	Filtered Water	-	70.0	45.7	0	-	-	-	-	-	2	7.9	-	11.0	-	-	-	-	-	-	-

*North of Meridian
**South of Meridian

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Treatment, Storage and Distribution

The treatment plant, designed for a capacity of eight mgd (two gallons/sq.ft./minute for sand filters), is composed of the following units: one flash mix, two flocculators of four mgd each, two settling basins of four mgd each, eight rapid sand gravity filters of one mgd each, three volumetric lime feeders, two volumetric alum feeders, one volumetric fluoridator, and five gas chlorinators. Activated carbon is added by an additional machine to control taste and odor problems which develop in the Spring. A fluoridator, chlorinator and one lime feed machine are used for post-chemical feed. During summer months the treatment plant is taxed to its design capacity. Old sedimentation basins are used for aeration and settling of water pumped from wells.

Treatment costs (includes utilities, labor, and chemicals) are approximately $31.00 per million gallons of water. The utility costs for pumping of water and operation of mechanical equipment averages approximately $1400 per month ($1000 for power and $400 for gas).

Finished water is stored in two clear wells of 70,000 and 900,000 gallon capacity. Water is pumped by two 5 mgd and one 4 mgd pump (two are electric, one natural gas powered) against a 98 pound per square inch pressure.

A 5.5 mg elevated storage tank floats on the distribution system southeast of the city. Another 3.0 mg elevated storage tank and booster pump station have recently been placed in service north

of the city. This pump station has one 2 mgd and one 1 mgd electric driven pumps, and one 2 mgd gas powered pump.

Present Water Demands for City of Meridian and Lauderdale County

The Meridian water system has an estimated 12,100 services providing water to approximately 50,000 persons and 46 major water using industries employing 3,000 persons in calendar year 1959. In 1959 the average daily demand was 5.4 mg, maximum was 7.3 mgd, maximum month was 184 mg. Public use of water is estimated to be 1.7 mgd. In 1954, a drought year, the water requirements were greater than this with maximum daily demands exceeding eight mgd. Maximum hourly demands are approximately 150 percent of the average hourly rate during the day.

For comparison, the average 1960 daily use of 5.5 million gallons (4.0 mgd from surface and 1.5 from ground sources) of the water from the Meridian municipal system is as follows:

	gpd	gpcd
Manufacturing industries	675,000	10
Service industries	25,000	
General population use	4,800,000	100
Total	5,500,000	110
Maximum total	8,200,000	164

Estimates were obtained for water demands on the ground water in Lauderdale County. The daily averages presently being used are:

Industry (City of Meridian-Table 6)	1,670,000
Misc. Industry (County)	500,000
Power Company (Make-Up Waters)*	1,370,000
Naval Base	200,000
Rural farm use (Table 7)	1,230,000
City of Meridian**	1,500,000
Total gpd	5,470,000

*This represents consumptive use of ground water. Approximately 80 mgd is used for cooling purposes. Cooling waters are recirculated.

**Largest demands are in summer when this rate may go to full capacity of two wells - 2.4 mgd.

TABLE 6
SUMMARY - INDUSTRIAL WATER USE - 1960
Meridian, Mississippi

Type of Industry	No. of Employees	Water Use - from Municipal Supply			Water Use - from Private Supply	
		Sanitary	Process	Cooling	Sanitary	Process
Apparel Manufacturing	383	7,760	14,940	-	-	-
Building Materials	462	7,040	52,140	-	2,200	-
Chemicals	108	2,160	4,190	-	-	-
Food Processing	529	8,685	109,935	8,000	700	166,240
Pulp and Paper	400	14,000	-	45,000	-	1,500,000
Stone, Clay and Glass	277	6,020	46,950	-	-	-
Wood Products	555	13,230	222,690	18,500	-	-
Laundry(Service Industry)	250	5,000	91,200	-	-	-
Totals	2,964	63,895	542,045	71,500	2,900	1,666,240

TABLE 7

CENSUS DATA AND FARM WATER USE - LAUDERDALE COUNTY, MISSISSIPPI

1959 Census Data	Lauderdale County
Rural Population (1960)	17,745
Number of farms	1,673
Total land area, acres	461,440
Land area in farms, acres	216,307
Average size of farm, acres	129.3
Irrigated farms	2
Acres irrigated	6
Number of cattle and calves	19,417
Number of milk cows	2,075
Number of horses and/or mules	1,557
Number of hogs and pigs	7,823
Number of sheep and lambs	-
Number of chickens	92,921
Number of turkeys	225
Water Use - gpd	
Rural Population	887,300
Irrigated land (18 inches/year)	7,000
Cattle	286,000
Horses and/or mules	18,700
Hogs and pigs	31,300
Sheep and lambs	-
Chickens	5,500
Turkeys	100
Total - gpd	1,235,900

Ground Water Yields

Ground water occurs under both water-table (nonartesian) and artesian conditions. Water-table conditions exist in the broad northwest-southeast trending belts of sandy outcrops of the Nanafalia and Tuscahoma formations in the central and northeastern parts of Lauderdale County and the Meridian sand and Sparta sand of the South-central and western parts of the county. The principal artesian aquifer is in the Nanafalia formation which furnished the large industrial and Naval Base Supplies, a part of the Meridian supply, and several smaller public supplies.

Yields ranging from 500 to 1,000 gpm have been recorded from wells 225 to 760 feet deep in the Nanafalia formation. Ground water in the much deeper Cretaceous formations is brackish to highly mineralized throughout the area. Records of water levels in wells of the Nanafalia formation indicate a slow rate of decline which over a 50-year period has averaged less than one-half foot per year in Meridian.

Pumping tests at McCain field and at Meridian indicate the Nanafalia artesian aquifer has a storage coefficient of approximately 0.0002 and a transmissibility of the order of 250,000 gpd per foot. The specific capacity of the first production well at McCain Field was 71 gpm per foot of drawdown after 18 hours pumping.

The two wells which furnish the ground water portion of the municipal supply at Meridian are reported to have specific capacities

of 48 and 32 gpm per foot of drawdown. These wells are developed in the middle part of the water-bearing zone.

The U. S. Geological Survey has reported that the effect of ground water withdrawals in the Meridian area cannot be accurately evaluated since adequate aquifer performance tests have not been made. However, periodic measurements since 1955 in a U. S. Fish and Wildlife well southwest of Meridian do not indicate a decline in water level. It is therefore likely that present pumpage from the Nanafalia formation might be multiplied several times without serious consequences other than the usual lowering of water levels with a steepened hydraulic gradient toward the center of pumping. Further study should be made of the water-bearing properties of the basal Nanafalia formation in and around Meridian.

SEWAGE DISPOSAL

Collection System

In 1956 the City of Meridian had a separate, gravity type sanitary sewage collection system, embracing 135 miles of branch sewers, mains, trunks and outfall lines. The incorporated area was well sewered, except for isolated residential areas and commercial establishments. Numerous areas outside of the corporate limits needed sewers, but political subdivision boundaries, pipe capacities and ridge lines limited extension. The system at that time discharged raw sewage into Sowashee Creek at three points.

Since 1956 other sewers have been built or planned to take care of the unsewered areas. Statistical data from the engineering

report gave the following information on the collection systems:

1. Unsewered Area - 1956

Dwellings outside sewered area	450	
Dwellings not sewered, but within limits of system	2,700	
Total dwellings not sewered		3,150
Persons outside sewered area	1,400	
Persons without sewers but within limits of sewer system	8,500	
Total persons without sewers		9,900

2. Sewered Area - 1956

1956 estimated total population	48,000	
Persons outside sewered area	1,400	
Potential population to be served		46,600
Persons having sewers	38,100	

Treatment Plant

An eight mgd activated sludge treatment plant has recently been constructed to receive and treat the municipal and industrial wastes of the city. The treated effluent flows into the Sowashee Creek south of the city.

Present Wastes Volume

Daily wastes flow through the municipal plant for the period December 1959 - January 1961 averaged 3.66 mgd. The five day 20°C. BOD of the raw wastes received averaged 151 ppm and the BODS of the treated wastes averaged 17 ppm, an 89% average reduction.

In an inventory of water use and estimated wastes production for 1960, the industries of Meridian were listed as contributing 0.3 mgd of the total wastes received at the municipal sewage treatment plant. The strength of these industrial wastes could not be

determined, but approximately one-sixth is sanitary waste and the remainder is process wastes.

Industry is presently discharging 0.78 mgd of sanitary and industrial wastes to storm drains and to Sowashee Creek. These untreated wastes enter Okatibbee Creek through Sowashee Creek southeast of the city. A small amount (5,000 - 10,000 gals.) of sanitary wastes is discharged to septic tanks and cesspools.

(6/1/61)

TABLE 8
SUMMARY - INDUSTRIAL PLANT WASTE - 1960
Meridian, Mississippi

Type of Industry	Sanitary Wastes				Industrial Wastes			
	To City Sewer		To Septic Tanks or Streams		To City Sewer		To Streams	
	Vol-gpd	Est. P.E.	Vol-gpd	Est. P.E.	Vol-gpd	Est. P.E.	Vol-gpd	Est. P.E.
Apparel Manufacturing	7,760	191	-	-	8,450	95	6,490	65
Building Materials	6,240	155	3,000	75	44,050	435	7,030	70
Chemicals	2,160	53	-	-	-	-	3,090	30
Food Processing	8,780	231	700	18	51,620	902	197,190	1,121
Paper and Pulp	-	-	14,000	200	-	-	500,000	20,000
Stone, Clay and Glass	5,080	117	940	23	27,700	unk.	400	unk.
Wood Products	12,230	217	1,000	60	34,720	1,390	36,670	1,470
Laundry (Service)	5,000	125	-	-	52,800	6,050	38,400	1,260
Totals	47,250	1,089	19,640	376	242,040	8,872	766,570	24,016

Other Wastes of County

Wastes in the Rural area of Lauderdale County, with exception of the Naval Air Base, are handled on an individual basis. The Naval Air Base is expected to handle its own waste problems, and the effluent will be released to streams of another basin.

PROJECTED ECONOMY OF LAUDERDALE COUNTY

Introduction

The economy of Lauderdale County can be expected to change from predominantly agricultural to a more balanced industrial - agricultural nature. Livestock production will continue to be the principal agricultural pursuit. Agriculture can be expected to make up a smaller share of total income of the county. The number of people on farms can be expected to decrease, and receive a larger per capita income.

The forest resource can be expected to become increasingly important to the economy of the county in the future. It will continue to provide employment to people who work in the forest as well as those engaged in manufacturing enterprises closely allied to forest production - pulp and paper products, lumber, furniture, and other wood products.

Population

The population of Lauderdale County was 73.5 percent urban in 1960. With the City of Meridian growing considerably faster than the county as a whole, it is anticipated that the county will be 83 percent urban in 1980 and 90 percent urban in 2015.

While the rural county population has been decreasing due to loss in number of farms and to urbanization, this trend can be expected to slow up in the future due to an increase in rural population engaged in government activity at the Naval Air Station. While the loss in rural population is expected to be slowed, it will continue. The loss in rural farm population and in rural non-farm population will not be offset by gains in the Naval Air Station.

The total population of Lauderdale County for 1960 and projected for the years 1980 and 2015 is shown in Table 9. The population of Rural Lauderdale County, outside Meridian, is shown in Table 10.

TABLE 9
PROJECTED POPULATION OF LAUDERDALE COUNTY

Population	Actual 1960	Projected 1980	Projected 2015
All Lauderdale County	67,119	78,000	116,000
City of Meridian	49,374	64,900	104,900
Rural County*	17,745	13,100	11,100

*Includes Naval Air Station

TABLE 10
PROJECTED POPULATION OF RURAL LAUDERDALE COUNTY

Population	Actual 1960	Projected 1980	Projected 2015
Number of farms	2,100	1,200	850
Rural farm population	7,400	4,200	3,000
Rural nonfarm population	10,345	4,900	2,700
Naval Air Station	-	4,000	5,400
Total rural population	17,745	13,100	11,100

Employment

Shifts in the employment pattern are expected to occur in Lauderdale County. Following the universal trend, employment in agriculture will decrease in the future. Mining is not important as an employer in the County. Increases in employment in construction, manufacturing, and government can be expected in the future. It is estimated that these three categories employed about 36 percent of total employment in the County in 1960 and are projected to employ 44 and 46 percent of the total employment in 1980 and 2015 respectively. Employment in the trades and services industries, although increasing in absolute terms, is expected to decrease in terms of percentage of total employment. It is estimated that 55 percent of total employment was engaged in the trades and services industries in 1960, and these two categories of employment are projected to employ 51 percent of total employment in both 1980 and 2015.

Estimated employment in 1960 and projected employment in 1980 and 2015 in Lauderdale County is shown in Table 11.

TABLE 11
PRESENT AND FUTURE EMPLOYMENT IN LAUDERDALE COUNTY

Employment Category	1960 No. Employed	1960 % of total	1980 No. Employed	1980 % of total	2015 No. Employed	2015 % of total
Agriculture	2,300	9.2	1,550	5.4	1,100	2.6
Construction	1,700	6.8	1,840	6.4	3,150	7.4
Mining	25	0.1	30	0.1	40	0.1
Manufacturing	5,200	20.7	6,300	21.8	9,700	22.9
Trade	6,050	24.1	6,450	22.3	9,800	23.1
Services	7,825	31.1	8,255	28.5	12,000	28.3
Government	2,000	8.0	4,525	15.5	6,600	15.6
Total	25,100	100.0	28,950	100.0	42,400	100.0

In the City of Meridian the employment pattern is slightly different from that in the county. Employment in the trades and services industries was estimated to account for 54 percent of total employment in 1960 and projected as 57 percent of total employment in 1980 and 2015. Employment in the basic industries (agriculture, mining, construction, manufacturing, and government) account for the remaining 46 and 43 percent respectively.

Employment in each of the major economic categories in the City of Meridian as estimated for 1960 and projected for 1980 and 2015 is shown in Table 12.

TABLE 12
PRESENT AND FUTURE EMPLOYMENT IN CITY OF MERIDIAN

Employment Category	1960 No. Employed	1960 % of total	1980 No. Employed	1980 % of total	2015 No. Employed	2015 % of total
Agriculture	230	1.2	200	0.8	160	0.4
Mining	20	0.1	25	0.1	40	0.1
Construction	1,600	8.5	1,700	7.2	2,900	7.7
Manufacturing	5,000	26.4	5,950	25.2	9,400	24.9
Trade	4,800	25.3	6,100	25.8	9,700	25.7
Services	5,500	29.0	7,400	31.3	12,000	31.7
Government	1,800	9.5	2,275	9.6	3,600	9.5
Total	18,950	100.0	23,650	100.0	37,800	100.0

It is anticipated that manufacturing employment will decrease slightly from 1960 when it was estimated to account for 26.4 percent of total employment in Meridian to 24.9 percent of the total projected for 2015. Employment in trades services, however, is expected to increase slightly. In 1960 it was estimated that 25.3 percent of the total employment was in trades and 29.0 percent was engaged in services. In the year 2015 it is anticipated that 25.7 percent

and 31.7 percent of total employment would be engaged in trades and services respectively. It is estimated that more than half of the manufacturing employment in 1960, 1980 and 2015 would be engaged in manufacturing enterprises that use raw materials and resources available in the area - food products, wood products, lumber, pulp and paper products, and stone, clay and glass products.

It is assumed that 40 percent of the total population in Meridian was in the labor force in 1960. It is projected that 38.0 percent and 37.5 percent respectively will be in the labor force in 1980 and 2015. The decline is due to the increased number of persons under age 14 and over age 65. It was assumed also that 96 percent of the labor force in Meridian would be employed in 1960, 1980 and 2015. The four percent unemployed represents the difference between persons employed and labor force. This percentage of employment is in line with full employment policy of the Nation. As shown in Table 13, the employment projections used will support the projected population of the City of Meridian.

TABLE 13
SUMMARY - PROJECTED EMPLOYMENT AND POPULATION OF MERIDIAN

Item	1960	1980	2015
Number People Employed	18,950	23,650	37,800
Number in Labor Force	19,700	24,600	39,400
Total Population	49,375	64,900	104,900

PROJECTED WATER DEMANDS

Rural Population

The 1960 rural population was composed of 7,400 persons on farms and 10,345 persons living in rural non-farm areas. Their estimated water requirements were 50 gals/person/day. Added to this were requirements for livestock watering, giving a total of 1.23 mgd necessary for rural Lauderdale County. Irrigation water was a minor part of this requirement.

The 1980 total rural population is estimated to be 13,100. Of this number 4,200 will live on farms, 4,900 on non-farms, and 4,000 will live on or near the newly established Naval Air Base.

By the year 2015 the total rural population will have dropped to 11,100. Of this total 3,000 will live on farms, 2,700 on non-farms, and 5,400 on or near the Naval Air Base.

There has been no indication of any water shortages, for the rural population. In most cases these persons have been served by individual wells.

The Naval Air Base in northeast Lauderdale County has drilled its own wells into the Wilcox water-bearing formation and is now obtaining all of its required water from these wells.

With reduction in number of farms and rural population the ground water in Lauderdale County will be sufficient to supply water needs for the rural, rural non-farm and Naval Base population. Need for surface water is not anticipated. Total requirements expected to be needed from wells will be approximately 2.5 mgd in

1980 and 2.7 mgd in 2015.

City of Meridian

In 1960 the population of Meridian on the municipal water system was using an average of 100 gpcd for municipal purposes. Industry was using 2.35 mgd in the Meridian area, seventy percent of this water being obtained from industry owned wells. If the city had been in a position to supply the population and industry with water, the 1960 capacity needed would be 7.15 mgd.

In 1980 the estimated demand for water will be 125 gpd for each person of the general population and 4.8 mgd to supply industry. Total demands on the city system will be approximately 12 mgd.

By 2015 the per capita consumption is estimated to increase to 150 gpd and industry will require 7.2 mgd. Total requirements will be 25 mgd.

It is to be noted that water requirements for the existing power generation plant south of Meridian has not been included in any of the previous listed requirements. Total water use by this plant is 1.37 mgd in 1960 and is expected to increase to 2.5 mgd in 1980 and 5.6 mgd in 2015. These demands are based on the consumptive use of water in boilers and that lost by evaporation on cooling towers. It is presently estimated that the cooling water is recirculated in excess of 60 times. The availability of ground water to meet the power company needs and the cost of pumping will dictate the source of their future water. More detailed analysis

of this problem is needed.

Total Water Requirements - Lauderdale County

The tabulation of water needs for Lauderdale County and the City of Meridian are shown in Table 14. Present use of ground and surface waters average approximately 10.5 mgd. Total requirements will be 17 mgd in 1980 and 33 mgd in 2015. The portions of total requirements which the city is not expected to provide amount to 3.3 mgd in 1960, 5 mgd in 1980 and 8.5 mgd in 2015.

TABLE 14
WATER NEEDS IN MGD - MERIDIAN AND LAUDERDALE COUNTY
YEARS 1960 - 1980 - 2015

Type of Use	Actual Use 1960	Estimated 1980	Estimated 2015
Manufacturing Industries	2.35	4.82[1/]	9.21[1/]
Misc. Industries (County)	0.50E	0.60E	0.70E
Naval Base	0.20[2/]	0.35E[2/]	0.45E[2/]
City of Meridian - Population	4.80	7.10[3/]	15.70[4/]
Power Company (cooling)	1.37	2.50[5/]	5.60[5/]
Rural Use	1.23	1.60	1.70
Totals	10.45	16.97	33.36
Amt. City not expected to provide	3.30	5.05	8.45
Amt. City must provide	7.15	11.92	24.91

1/ Based on projected industrial growth and best source of water requirements for different types of industry. Increased by 25% in 2015 because of increased production.

2/ Calculated for 1600 permanent residents, 100,000 gpd for 1980 and 120,000 in 2015 for base operation, and 20 gpd per employee.

3/ Calculated at rate of 125 gpcd

4/ Calculated at rate of 150 gpcd

5/ Based on percentage population increase and per capita increase in power consumption (5000,8000, and 12,000 in 1960, 1980 & 2000)

VALUE OF WATER

Proposed Reservoir

For purposes of determining value of water, two alternative sources of water were studied for the most likely and least costly source that might be used in the absence of the Corps Project. These sources were a single purpose water supply reservoir located at the proposed Corps site and ground water. Cost of securing water from both sources were compared and the surface water chosen as the cheaper and most likely one to be developed.

In the study of ground water as a source, it became apparent that insufficient information was available to determine the safe yield of the present water bearing aquifer (Nanafalia Formation, Wilcox Group), to meet the future demands. Two opinions were expressed that the pumpage from this aquifer could be increased several times without seriously lowering the ground water table. Based on these opinions this source was considered as an alternate but eliminated in the final analysis because of its higher costs.

Even though ground water was eliminated as a source of water for the City of Meridian, it will still supply most of the water for rural areas of Lauderdale County, including the Naval Air Base. Also industrial water for boilers and cooling purposes at Mississippi Power Company's Plant Sweatt will still be obtained from ground water. This last major user of water was not considered in the over-all total surface water requirements for the following reasons:

1. Location - The distance of the plant from the city leaves doubt that it would obtain water from the city.
2. Water Quality - The quality of water needed by the plant is different from that of the city and therefore will require different treatment.
3. Quantity - The growth of the plant and therefore its needs for water could not be satisfactorily determined. At present it is comtemplated that ground water will be sufficient for immediate needs. However, more detailed determination are needed for long range water requirements for this plant.
4. Alternative Source - Another possible solution to the power company's requirements is the use of waste waters released by the City of Meridian to Okatibbee Creek. This water would have to be treated by the plant before use for cooling purposes.

Based on 1961 prices the annual value of water stored in the proposed Corps of Engineers Okatibbee Creek, Mississippi project which is designed to supply, at the end of the economic life of the project, an average of 25 mgd would be $102,000. This value is based on a single purpose water supply reservoir with an economic life of 50 years and amortized at a four percent interest rate.

Water Quality Management

Comprehensive water resource development must of necessity include consideration of stream quality maintenance. As an area surrounding a water resource project develops, and the use of water

for municipalities and industries increases, the amount of wastes produced in the area likewise increases. Disposal of the wastes to the watercourses, whether treated or not, will affect the water quality of these streams.

The maintenance of an adequate stream quality is a definite asset in the proper development of an area. Although difficult to evaluate, benefits from the maintenance of good quality surface waters do exist and should be considered in all water resource development projects.

In the project under study, estimates of future water demands for the Meridian, Mississippi area have been made. Of the 25 mgd projected as the city's water demand by the year 2015, it is estimated that only five mgd will actually be consumed, leaving 20 mgd to carry the wastes produced by the people and industry in the area. These wastes will be treated and discharged to Okatibbee Creek.

Maintenance of a good quality water in stream can be accomplished by providing treatment of the wastes, sufficient stream flow to assimulate the wastes without nuisances, or a combination of both. In the Meridian area, it appears that the combination of wastes treatment and low flow augmentation will be required to maintain the waters of Okatibbee Creek in a reasonable quality condition. Based on preliminary estimates of the amount and type of wastes expected and the wastes assimilation capacity of Okatibbee Creek, it has been estimated in this particular case that for every gallon of treated wastes discharged to Okatibbee Creek from Meridian, approximately

three gallons of dilution water will be required to prevent the development of nuisance conditions in the stream. If it is desired to maintain the stream in a state that would support a healty, vigorous biological environment, then about five gallons of dilution water would be required for every gallon of treated wastes discharged. Hydrologic studies would be needed to determine when this dilution water would be provided by natural stream flow and when it would need to be provided by reservoir releases. Additional studies are also necessary to more definitely determine dilution water requirements.

It is recognized that existing legislation makes no provision for inclusion of storage in Federal projects for low-flow augmentation on a non-reimbursable basis. However, if the area is to develop fully, water quality management through low-flow augmentation should be considered in more detail than has been attempted in this report.

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